Adapting Acoustic Water Filtration Concept for Heavy Sour to Light Sour Crude Conversion Without Distillation

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Introduction

Crude oil refining is an energy-intensive process whereby extremely expensive equipment is used to distill desired petroleum byproducts through the use of heat, evaporation and condensation. A heat-driven process for crude oil refinement not only wastes energy, but drives up the cost of establishing new refineries to the point where there has been little interest in establishing new refineries despite the improvements to delivery efficiency and supply chain resiliency which would result from the construction of additional refineries.

It is important to understand, prior to explaining the core concept of this abstract, the difference between heavy sour crude and light, sweet crude. Heavy sour crude contains greater proportions of dissolved solids and lesser amounts of the desirable components such as ethylene, benzene and kerosene. This means that an oil company stands to make a greater profit by extracting light, sweet crude and refining that product than by purchasing heavy, sour crude. So long as light, sweet crude is available, this is generally the product which is utilized in order to satisfy domestic petroleum needs.

Abstract

Just as particulates in water ranging from the microscopic to the large can be eliminated through an acoustic process (ibid.,) crude oil may be addressed as a sort of extremely dirty fluid in need of cleaning. Rather than evaporating desired components and condensing them (or at least not performing this step primarily,) dissolved solids in heavy, sour and perhaps even in light, sweet crude could be made to coalesce and sink to the bottom of a collection vessel using a system of structured acoustic energy which is aimed at the phased binding of molecules, ultimately, into large clumps. Heavy crude could be made to be light and light crude could be made to be lighter i.e. cleaner.

Acoustic energy of extremely high frequency can be anticipated to result in the binding of microscopic fluid contaminants into larger clumps (ibid. 2021 paper.) These pulses may be programmatically stepped down to lower frequencies which result in those clumps binding with existing particulates of a slightly larger size and those clumps binding with others et cetera. This tendency toward clumping may be further enhanced by the introduction of modest voltage into the fluid.

Progressively larger clumps are created by this process as the frequencies ultimately fall into the audible range and the process ends with a visible separation of the tar component and the gasoline component. While this process

would result in particulate "kick up" when the clumps hit the bottom of the collection vessel in the case of water, in oil, the effect would be minimal. In the case of oil, clumped tar tends not to easily re-dissolve, meaning that the range of acoustic harmonics can be re-run repeatedly in order to further increase purity.

Implications for Viability of Investment in Venezuelan Zone of Interest

If there were a mere method for converting heavy, sour crude into light, sour crude (barring the total success of the method as a full-on replacement for distillation, which is the ultimate goal) it would nonetheless improve dramatically the viability of Venezuelan mineral exploration and acquisition. While conversion of heavy sour crude in this manner cannot make it "sweet" i.e. rich in gasoline component molecules, it does reduce the costs associated with the separation and disposal of tar for reason that heating these dissolved solids causes them to adhere to the interior of heating vessels which must be routinely cleaned; a hazardous and expensive proposition. Acoustic elimination of the majority of the dissolved solids prior to heating/distillation would eliminate much of the cost associated with refinement, particularly with regard to heavy, sour crude.

Conclusion

Depending upon the level of purity attainable through this approach, a heating and distillation step may yet be required to create refined products of the desired quality, but in the case of heavy, sour crude, the ability to eliminate the vast majority of the particulates prior to heating would dramatically ease the process of heavy, sour crude refinement.